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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES



In re application of

: Confirmation No. 7179

Keiichi TAKANASHI et al.

: Docket No. 2001_0689A

Serial No. 09/867,628

: Group Art Unit 1765

Filed May 31, 2001

: Examiner Matthew J. Song

APPARATUS FOR PULLING
A SINGLE CRYSTAL

APPELLANTS' BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

THE COMMISSIONER IS AUTHORIZED
TO CHARGE ANY DEFICIENCY IN THE
FEES FOR THIS PAPER TO DEPOSIT
ACCOUNT NO. 23-0975

Sir:

This is an appeal from the final rejection of claims 7-14.

1. REAL PARTY IN INTEREST

The real party in interest of this application is Sumitomo Metal Industries, Ltd. of Osaka, Japan.

2. RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

3. STATUS OF CLAIMS

Claims 1-6 have been cancelled. Claims 7-14 have been rejected.

4. STATUS OF AMENDMENTS

No amendments subsequent to the final rejection of October 1, 2002 have been made.

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5. SUMMARY OF THE INVENTION

The present invention is to provide an apparatus for pulling a single crystal of good quality. In order to pull a single crystal of good quality, it is important to control the positioning of the crucible with respect to the level of the melt in the crucible. One reason for this is that during the pulling of a crystal, the surface level of the melt is to be maintained at a fixed relationship with respect to a heater that is heating the melt. Since the amount of melt in the crucible decreases as the crystal is pulled, the surface level also decreases. Therefore, the crucible position must be adjusted during the pulling of a crystal. However, controlling the position of the crucible based on the amount of melt that is lost due to the formation of the crystal does not take into account other potential factors that could affect the measurement of the surface level of the melt, such as the crucible's diameter changing due the heat generated by the heater and the effect that the speed of rotation of the crucible during pulling has on the surface level of the melt. (See paragraphs [0009] - [0014]).

The present invention was developed in order to more precisely control the level position of the crucible so that high quality single crystals can be pulled. In order to achieve this object, the present invention is an apparatus for pulling a single crystal which has lifting means for lifting a crucible and level position controlling means to control the lifting means, thereby controlling the level position of the surface of the melt in the crucible. (See Figure 1, element 20). The level position controlling means controls the level position based on just an ascent speed when certain criteria are not satisfied and controls the level position based on the ascent speed adjusted by an adjustment amount when the criteria are satisfied. (See Figure 2, steps S9-S12). The adjustment amount acts to address inaccuracies in the measurement of the amount of melt lost from the crucible due to pulling. As examples of the criteria that can be used to determine whether or not the adjustment amount is added to the ascent speed, the diameter of the crystal's main body, the level position of the melt, the distance between the crystal and a reference reflector, and the rotational speed of the crucible can be used. (See paragraphs [0033] - [0041]).

Independent claim 7 reflects the present invention by reciting an apparatus for pulling a single crystal, the apparatus having, in part,

level position controlling means for controlling a level position of said crucible via said lifting device, said level position controlling means comprising:

diameter measuring means for measuring a diameter of the single crystal;

crucible ascent speed calculating means for calculating a decrease in volume of the melt based on the diameter of the single crystal measured by said diameter measuring means and a pulled crystal length of the single crystal and calculating an ascent speed of said crucible based on the decrease in volume of the melt, wherein

said level position controlling means controls the level position of said crucible based on the ascent speed adjusted by the adjustment value when certain criteria are satisfied and said level position controlling means controls the level position of said crucible based on just the ascent speed when the certain criteria are not satisfied.

6. ISSUES

The only issue on appeal is whether claims 7-14 are indefinite due to the use of the term "certain criteria" in claim 7.

It is noted that in the final Office Action of October 1, 2002, rejections under 35 U.S.C. §112, first and second paragraphs, were made by the Examiner. In response to the final Office Action, a first Request for Reconsideration was filed on January 2, 2003. The Examiner then issued a first Advisory Action on January 13, 2003 which withdrew the rejection under 35 U.S.C. §112, first paragraph, and restated the rejection under 35 U.S.C. §112, second paragraph. In response to the first Advisory Action, a second Request for Reconsideration was filed on March 23, 2003. The Examiner then issued a second Advisory Action on April 9, 2003 further restating the rejection under 35 U.S.C. §112, second paragraph.

7. GROUPING OF THE CLAIMS

Claims 7-14 stand or fall together.

8. ARGUMENT

The Examiner's position is that claims 7-14 are indefinite under 35 U.S.C. §112, second paragraph, because of the use of the term "certain criteria" in claim 7. The Examiner indicates that the term "certain criteria" is defined in the specification, but the actual criteria detailed in the specification are indefinite.

Specifically, the Examiner indicates that the examples of the "certain criteria" in the specification are indefinite because ranges of values are disclosed without being associated with specific initial values. The criteria outlined by the Examiner as having this problem are: (1) the upper and lower limits of a crystal diameter are within the range of $\pm 2\text{mm}$ within a desired diameter of a main body of a single crystal; (2) the upper and lower limits of the level position are within the range of $\pm 5\text{mm}$ to an initial position; and (3) the upper and lower limits of the crucible rotation speed are within the range of $\pm 10\text{ rpm}$ to the crucible rotation speed at an early stage of forming the main body. (See paragraphs [0033], [0048], [0059] and [0060]).

It is the Applicants' position that: (1) the rejection under 35 U.S.C. §112, second paragraph, as discussed above, is an improper use of 35 U.S.C. §112, second paragraph; (2) the Examiner's reading of the specific criteria used as examples in the embodiment discussed in the specification into the claims is improper; and/or (3) the criteria included in the specification are, in fact, definite to one of ordinary skill in the art.

Under 35 U.S.C. §112, second paragraph, there are two requirements that must be met: (1) the claims must set forth the subject matter that the Applicants regard as their invention; and (2) the claims must particularly point out and distinctly define the metes and bounds of the subject matter that will be protected by the patent grant. (See M.P.E.P. §2171). It is apparent that the indication that the claims are indefinite because the criteria discussed in the specification are not clearly defined falls under neither of these requirements, and therefore the rejection is improper.

Regarding the first requirement, M.P.E.P. §2172 states that the claims must set forth the subject matter that the Applicants regard as their invention. Further, a rejection under this requirement is appropriate only where Applicants have stated, somewhere other than in the application as filed, that the invention is something different than what is defined in the claims. It

is apparent that this is not an issue in the present application, as there is no question that the Applicants are claiming what they deem is their invention.

Regarding the second requirement, M.P.E.P. §2173 states that the second requirement's main purpose is to ensure that the scope of the claims is clear so that the public is informed of the boundaries of what causes infringement of the patent. A second purpose is to provide a clear measure of what the Applicants regard as their invention. It is submitted that claims 7-14 satisfy the second requirement of 35 U.S.C. §112, second paragraph, as currently drafted, for the following reasons.

The phrase "said level positioning controlling means controls the level position of said crucible based on the ascent speed adjusted by the adjustment value when certain criteria are satisfied and said level position controlling means controls the level position of said crucible based on just the ascent speed when the certain criteria are not satisfied" in claim 7 clearly indicates that the level positioning controlling means controls the level position of the crucible in different ways depending on whether certain criteria are satisfied. This limitation is fully supported by the specification at paragraphs [0033] and [0034] as well as other locations throughout the specification. As a result, there is no question as to what is taking place in this phrase and the boundaries of what is claimed are clearly defined. Therefore, the second requirement of 35 U.S.C. §112, second paragraph, is satisfied.

Despite the fact that the two requirements of 35 U.S.C. §112, second paragraph, as detailed in the Manual of Patent Examining Procedure, have been satisfied, the Examiner states that the rejection was made because the criteria as discussed in the specification are not clearly defined. It is unclear how this indication that the criteria discussed in the specification results in a rejection under 35 U.S.C. §112, second paragraph, since 35 U.S.C. §112, second paragraph, clearly outlines requirements for what is claimed, not what is discussed in the specification. Therefore, it is apparent in the present situation that the scope of the claims is clear and that this rejection under 35 U.S.C. §112, second paragraph, is improper.

In addition to the rejection under 35 U.S.C. §112, second paragraph, being improperly applied, it is also apparent that the three criteria detailed in the rejection as being indefinite are, in fact, not recited in claims. Instead, the limitation in question relates to "level position controlling

means” which controls a level position of a crucible in different ways depending on whether “certain criteria” are satisfied. (See claim 7). Therefore, it appears that the Examiner is improperly reading the three criteria into the claims in making this rejection.

As detailed in M.P.E.P. §2111.01, during examination, claims must be interpreted as broadly as their terms reasonably allow. This means that the words of the claim must be given their plain meaning unless the Applicants have provided a clear definition in the specification. (See M.P.E.P. §2111.01 citing In re Zletz, 893 F.2d 319, 321 (1989)). Further, this section of the M.P.E.P. states that “[o]ne must bear in mind that, especially in non-chemical cases, the words in a claim are generally not limited in their meaning by what is shown or disclosed in the specification. It is only when the specification provides definitions for terms appearing in the claims that the specification can be used in interpreting the claim language.” (Citing In re Vogel, 422 F.2d 438, 441 (CCPA 1970)).

Based on the above explanation of claim interpretation, it is apparent that the term “certain criteria” should be given its plain meaning when being interpreted, since the criteria set forth in the specification brought into question in the rejection do not define the term “certain criteria”, but are only examples of possible criteria that can be used to determine whether or not the level position controlling means uses the adjustment value to control the level position of the crucible. Further, the term “certain criteria” should not be limited to the criteria discussed in the specification.

As further evidence that the Examiner is improperly reading the three criteria listed above, it is noted that the specification also sets out a fourth example of a criteria that can be used. The criteria is that the lower limit of the distance between the single crystal and the reference reflector is 22mm. (See paragraph [0033]). It is apparent that based on the fact that a specific minimum distance, 22mm, between the single crystal and the reference reflector is specifically disclosed, there is no question as to the definiteness of this criteria. Since, at a minimum, at least one of the four criteria detailed in the specification is definite, it appears that the Examiner’s position that claim 7 is indefinite because the criteria listed in the specification are indefinite necessitates the reading in of at least one of the three criteria discussed above into claim 7. However, while the embodiment of the level position controlling means detailed in the specification relies on these

four criteria, there is no indication in the specification that any of the criteria set forth therein are necessary or must be used by the level position controlling means. As a result, not only is the Examiner improperly reading the criteria discussed in the specification into claim 7, he is doing so in an arbitrary fashion.

It also must be pointed out that while words of a claim must generally be given their plain meaning, there is one exception to this rule. As discussed in M.P.E.P. §2111.01, when an element is claimed using language falling under 35 U.S.C. §112, sixth paragraph, the specification must be consulted to determine the structure, material or acts corresponding to the function recited in the claim. (Citing In re Donaldson, 16 F.3d 1189, 29 (1994)). Therefore, the specification should be referred to to determine the structure associated with the "level position controlling means". However, as discussed above, the specific criteria discussed in the specification should not be read into the claimed phrase, "certain criteria".

Further, even if it is determined that the Examiner has properly read at least one of the three criteria in question into the claims, it is apparent that these three criteria are definite to one of ordinary skill in the art. A discussion of each of the three criteria is detailed below.

The first criteria indicated as being indefinite is that "the upper and lower limits of a crystal diameter are within the range of ± 2 mm within a desired diameter of a main body of a single crystal." The rejection indicates that the term "desired diameter" is indefinite for not providing any actual value for the diameter of the single crystal to which the range can be applied. However, as is well known to one of ordinary skill in the art, diameters of single crystals are standardized in the industry at, for example, six inches, eight inches, and twelve inches.

It is also noted that paragraph [0056] of the specification details an example in which the present invention was used where a single crystal having a mean diameter of 8 inches was pulled. In addition, this example indicates in paragraph [0054] that the internal diameter of the crucible was 22 inches. Based on this disclosure and the industry standardization discussed above, it is apparent that one of ordinary skill in the art would be able to determine what is a reasonable desired diameter for the main body of the single crystal. As a result, the term "desired diameter" is definite because at least one crystal diameter is disclosed in the specification.

The second criteria indicated as being indefinite is that “the upper and lower limits of the level position are within the range of ± 5 mm to an initial position.” The rejection indicates that the term “initial position” is indefinite because the specification does not provide any actual indication of the initial position of the level position. Regarding this, it is noted that the initial position of the level position varies depending on, for example, the amount of feeding material used in each batch. However, the initial position of the level position, itself, is not crucial, but that the level position is within the range of ± 5 mm of the initial position. Therefore, once the initial position of the level position is set, the level position should be maintained within ± 5 mm of this initial position. As a result, it is apparent that there is sufficient disclosure in the specification regarding this criteria.

The third criteria stated as being indefinite is that “the upper and lower limits of the crucible rotation speed are within the range of ± 10 rpm to the crucible rotation speed at an early stage of forming the main body.” The rejection indicates that the term “crucible rotation speed at an early stage of forming the main body” is indefinite because the specification does not provide any explicit indication of the crucible rotation speed. Regarding this, it is noted that one of ordinary skill in the art would understand that this speed is dependent on the target oxygen concentration of the single crystal in a batch. Further, one of ordinary skill in the art would also understand that the crucible rotation speed changes as the pulling operation proceeds and that the language “at an early stage of forming the main body” indicates the crucible rotation speed at a beginning of the formation of the main body of the crystal.

Also, it is noted that the crucible rotation speed at the early stage of forming the main body is not what is crucial, as it will be varied depending on a number of factors, including the target oxygen concentration, but that the crucible rotation speed is within the range of ± 10 rpm of the crucible rotation speed at the early stage of forming the main body. Therefore, once the crucible rotation speed at the early stage of forming the main body is set, the crucible rotation speed should be maintained within ± 10 rpm of this speed. As a result, it is also apparent that there is sufficient disclosure in the specification regarding this criteria.

9. **APPENDIX**

A copy of the claims on appeal is set forth in an Appendix immediately following the conclusion and signature, and is incorporated herein by reference.

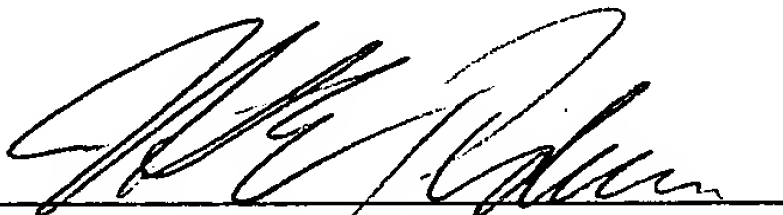
10. **CONCLUSION**

In view of the above, it is respectfully submitted to be clear that the rejection of claims 7-14 under 35 U.S.C. §112, second paragraph, as set forth in the final Office Action and restated in the first and second Advisory Actions is improper for three reasons. First, the rejection is an incorrect application of 35 U.S.C. §112, second paragraph. Second, the Examiner's reading of the specific criteria used as examples in the embodiment discussed in the specification into the claims is improper. Third, the criteria included in the specification are, in fact, definite to one of ordinary skill in the art. As a result of these reasons, a favorable decision by the Board of Patent Appeals and Interferences is respectfully requested.

This brief is submitted in triplicate with the requisite fee of \$320.00.

Respectfully submitted,

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APPENDIX - Claims on Appeal

7. An apparatus for pulling a single crystal, said apparatus comprising:
an apparatus body;
a crucible located in said body, said crucible adapted to hold a melt;
a lifting device being operable to lift said crucible;
a reference reflector located inside said apparatus body;
an optical device located outside of said apparatus body; and
level position controlling means for controlling a level position of said crucible via said lifting device, said level position controlling means comprising:
diameter measuring means for measuring a diameter of the single crystal;
crucible ascent speed calculating means for calculating a decrease in volume of the melt based on the diameter of the single crystal measured by said diameter measuring means and a pulled crystal length of the single crystal and calculating an ascent speed of said crucible based on the decrease in volume of the melt;
level position measuring means for measuring an actual level position by detecting a mirror image position of said reference reflector reflect by a surface of the melt using said optical device; and
crucible ascent speed adjustment value calculating means for calculating an adjustment value of the ascent speed of said crucible based on an output from said level position measuring means, wherein
said level position controlling means controls the level position of said crucible based on the ascent speed adjusted by the adjustment value when certain criteria are satisfied and said level position controlling means controls the level position of said crucible based on just the ascent speed when the certain criteria are not satisfied.
8. An apparatus according to claim 7, further comprising adjustment value adding means for adding the adjustment value to the ascent speed.

9. An apparatus according to claim 8, further comprising adjustment value addition proprietary judging means for judging whether the certain criteria are satisfied for adding the adjustment value to the ascent speed, wherein the certain criteria are a diameter of the single crystal, the actual level position measured by said level position measuring means, a distance between the single crystal and said reference reflector, and a crucible rotational speed.

10. An apparatus according to claim 8, further comprising averaging means for averaging a plurality of level positions measured by said level position measuring means.

11. An apparatus according to claim 8, wherein said optical device is also used in measuring the diameter of the single crystal.

12. An apparatus according to claim 8, further comprising automatic updating means for automatically updating a conversion equation for converting the mirror image position of said reference reflector on the surface of the melt to the actual level position by moving said crucible up and down from an initial position to obtain a relationship between the mirror image position of said reference reflector on the surface of the melt and the actual level position and making the relationship approximate to a straight line.

13. An apparatus according to claim 8, wherein said optical device comprises a first camera and a second camera, said first camera being operable to measure the actual level position and said second camera being operable to measure the diameter of the single crystal.

14. An apparatus according to claim 9, further comprising averaging means for averaging a plurality of level positions measured by said level position measuring means.